

We claim:

1. A touch screen display apparatus comprising:

a liquid crystal panel having a viewing area with a periphery;

a plurality of shockwave detectors, disposed about said periphery; and

said plurality of shockwave detectors configured to use a time of arrival of a shockwave to determine a point of origin of the shockwave in the liquid crystal panel which results from a touch occurring at said point of origin.

2. A display of claim 1 wherein said periphery is free from a plurality of pairs of opposing transmitters and receivers disposed about said periphery where said plurality of pairs of opposing transmitters and receivers are configured to detect a presence of an object disposed on the viewing area and between said transmitters and said receivers.

3. A display of claim 2 wherein said viewing area is free from an electrically conductive transparent layer and free from a connection to an electronic detection means which is configured to detect touching.

4. A display of claim 1 further comprising:

a first array of shockwave detectors, disposed along a horizontal edge,
which define a plurality of columns across said viewing area; and,

a second array of shockwave detectors, disposed along a vertical edge,
which defines a plurality of rows across said viewing area.

5. A display of claim 4 further comprising a third array of shockwave detectors opposite said first array of shockwave detectors and a fourth array of shockwave detectors opposite the second array of shockwave detectors.

6. A display of claim 4 wherein said liquid crystal panel is a multi-domain vertically aligned liquid crystal cell.

7. A display of claim 6 further comprising:

means for determining a location of a tactile interaction on said viewing area by analyzing a time of arrival difference of a shockwave, due to said tactile interaction, on at least two non-co-located points.

8. A display of claim 7 further comprising an active thin film transistor layer in said liquid crystal panel; and,

wherein said first array of shockwave detectors is integrated into said thin film transistor layer.

9. A display of claim 8 wherein said first array of shockwave detectors is configured to detect a change of capacitance of said liquid crystal material in response to presence of a shockwave.

10. A display of claim 8 wherein said first array of shockwave detectors is configured to detect a change of resistance of said liquid crystal material in response to presence of a shockwave.

11. A method of detecting a touch on a viewing panel of a liquid crystal display, comprising the steps of:

providing a display panel comprising a liquid crystal material, said display having a viewing area;

tapping a first location on said viewing area and thereby generating a shockwave as a result of such tapping;

providing a plurality of shockwave detectors which are not located at a single location;

detecting an arrival of said shockwave at each of said plurality of shockwave detectors;

determining a time of arrival of said shockwave at each of said plurality of shockwave detectors; and,

locating said first location in response to said step of determining a time of arrival of said shockwave.

12. A method of claim 11 wherein said relative time of arrival is based upon a plurality of times of arrival of said shockwave at a plurality of shockwave detectors.

13. A method of claim 12 wherein said step of detecting an arrival of said shockwave comprises the steps of detecting a change in a predetermined electrical characteristic of said liquid crystal material in response to a presence of said shockwave.

14. A method of claim 12 wherein said step of detecting an arrival of said shockwave comprises the steps of detecting a change in a predetermined optical characteristic of said liquid crystal material in response to a presence of said shockwave.

15. A method of claim 11 wherein said step of locating said first location comprises using a triangulation computation.

16. A method of claim 11 wherein said step of locating said first location comprises a determination of a row and a column.

17. An apparatus for detecting a tactile stimuli upon a viewing area of a liquid crystal display comprising:

a liquid crystal material having a viewing surface;

a plurality of shockwave detectors disposed about a periphery of said viewing surface; and

means for performing a triangulation computation to determine a location of a point of tactile stimulation on said viewing surface, said means for performing being responsive to signals representative of a detection of a shockwave by said plurality of detectors.

18. An apparatus of claim 17 wherein said plurality of shockwave detectors comprises a plurality of optical sensors disposed on a layer having thin film transistors thereon, where said plurality of optical sensors measures an optical characteristic of a segment of said liquid crystal material.

19. An apparatus of claim 18 wherein said optical characteristic is a brightness of light reflection of a surface on an opposite side of said liquid crystal material from said layer.

20. An apparatus of claim 19 wherein said means for performing a triangulation computation determines a relative time of arrival of a shockwave at said plurality of shockwave detectors.